Section 14 Asset Class – Traffic Signal System:

The Traffic Signal System asset class includes of all of the assets that are either electrically- or solar-powered and comprise the system that regulates and manages the flow of traffic. It includes:

- ✓ Beacons
- ✓ CCTV Camera Assemblies
- ✓ Traffic Management Center
- ✓ Traffic Signal Assemblies
- ✓ Traffic Signal Communication System

Budgets for the assets in this asset class are included in a combined 2010 general maintenance budget of $7.5. m.

The traffic signal system is maintained by Traffic Maintenance crews at the direction of the Traffic Signal Operations group in the Traffic Management Division.

School Beacon

Beacons:

A beacon is a warning device the purpose of which is to draw a vehicle operator's attention to an associated message that is important to the safe operation of the vehicle on a specific stretch of roadway.

There are a variety of beacons, examples include school zone beacons, all-way stop beacons, and emergency warning beacons.

Many of the beacons operate on schedules and have one or more scheduled periods of operation during the day. School beacons are operational twice daily (morning and afternoon) during pre-determined ranges of hours when children are present. All-way stop beacons and emergency/warning beacons are operational on a 24/7 basis.

Current Inventory and Anticipated Annual Growth:

There are an estimated 280 beacons in the city of Seattle, 82 of which are school beacons..

The inventory of beacons is maintained in the Hansen system by staff members in the Traffic Management Center who are also responsible for programming/scheduling the hours of operation for these devices. .

Approximately 10-12 new beacons are installed each year.

The estimated replacement value of beacons is $ $1,000,000 to $5,600,000 Where expressed elsewhere in this document for summary purposes, a replacement value of $2.5 million has been used.

Useful Life and Life Cycle Costs:

A beacon can be expected to have a useful life of twenty (20) years, and the cost of acquisition and installation is $3,000-$20,000. When a beacon reaches half its useful life, it generally degrades to fair condition. If it degrades to poor condition, the beacon will require replacement in approximately four (4) years.

Maintenance costs have not been tracked independently for this asset and have been included in a general maintenance budget, hence, life cycle costs are not available.

Maintenance Approach and Funding

Prior to 2007, the maintenance approach for beacons was to respond to damage or operational problems as reported and according to maintenance priorities. If the reported problem was safety-related, response has been immediate. Beacons are expected to operate correctly 98% of the scheduled up-time. During 2010, beacon maintenance suffered a mid-year budget reduction to eliminate any opportunity for programmed maintenance.

Since limited information is available about the beacons, specifically age and condition, it is difficult to assess funding needs in any specific year. Using a life cycle of twenty years for replacement approximately fourteen beacons should be replaced annually, at a cost of approximately $154,000 per year. As of 2010, replacements and preventive maintenance are no longer funded because of severe budget constraints.

Camera Assemblies:

Camera assemblies under the management of the SDOT traffic Division include closed circuit television (CCTV) and license plate readers. A CCTV (closed circuit television) camera assembly provides video images of traffic and roadway conditions to the Traffic Management Center, as well as to the public on the city's web page. These images provide information to assist motorists in making intelligent decisions with respect to their trips, and thereby reduce travel time. A CCTV camera assembly also assists SDOT in diagnosing potential and actual traffic congestion and in making good decisions about changes in synchronization of traffic signals that will enhance the flow of traffic. The license plate readers are cameras that collect data to measure point to point travel times that is converted to information to display congestion levels on the department's traveler's information map.

Current Inventory and Anticipated Annual Growth:

There are 226 camera assemblies in the city of Seattle. The inventory of cameras is maintained in the Hansen enterprise data repository by the Traffic Signal Shop.

There has been a high rate of growth in recent years in the camera inventory related to the web-based traveler's information system maintained by the department..

The estimated replacement value of CCTV camera assemblies is $1.2 million to $2.4 million in current dollars. Where expressed elsewhere in this document for summary purposes, a replacement value of $1.8 million has been used.

Useful Life and Life Cycle Costs:

A camera assembly can be expected to have a useful life of ten (10) years, and the cost of purchase and installation is $5,300 to $10,750 (excluding pole installation). After approximately seven (7) years, it generally degrades to fair condition. If it degrades to poor condition, the camera assembly will require replacement in one (1) year.

Maintenance costs have not been tracked independently for this asset and have been included in a general maintenance budget; hence, life cycle costs are not available.

Maintenance Approach:

The maintenance approach for camera assemblies is to respond to damage or operational problems as reported and according to maintenance priorities. Safety issues are addressed immediately. Camera assemblies are expected to operate correctly 98% of the scheduled up-time.

Additional funding is required to establish a preventive maintenance program for these devices.

Current Performance Measures:

Performance measures have not been developed for camera assemblies.

Funding Requirements and Unmet Funding Needs:

Approximately $100,000 from the combined general maintenance budget has been allocated for maintenance of camera assemblies.

Accurate costs of maintenance have not been determined.

Replacement of these devices should be expected starting in 2012 and is not an immediate funding need.

Traffic Management Center:

The Traffic Management Center (TMC) is the central command center for the SDOT computerized traffic signal system. The TMC plays a vital role in the overall operation of Seattle's transportation system, housing the central computerized control system for nearly 600 of the 1000+ signalized intersections, as well as the main communication hub that provides connectivity between the central system and those intersections. The TMC is home of the camera control system, providing the necessary equipment and computer power to operate the system and produce the video images generated for public viewing on the SDOT web page. The TMC also controls the dynamic message signs deployed on Seattle's streets.

The TMC was put into operation in 2002 in the Seattle Municipal Tower (SMT). It is staffed intermittently from 6 AM to 6 PM to monitor the effective operation of the TMC and the traffic signal system.

TMC Video Wall

Current Inventory, Condition Ratings, and Useful Life and Life Cycle Costs:

The TMC houses numerous electronic components. These components have not been inventoried and recorded separate from the TMC.

Condition ratings have not been assigned to the components, although most electronic components have life cycles of four (4) years or less at which point they will be replaced by newer technology. The electronic component with the longest useful life is the video wall which is twelve (12) years.

Useful life for the TMC itself is indeterminate since a TMC in some form will always be required.

The estimated replacement value for the TMC has not been determined.

Maintenance costs have not been tracked separately for the TMC.

Maintenance Approach and Current Performance Measures:

The TMC is scheduled to function on a 24/7 basis and is expected to operate 99.9% of that time. The remaining 0.1% is planned down-time for scheduled maintenance activities.

An Uniteruptible Power Supply (UPS) system and generator have been deployed to isolate the TMC from the effects of unplanned down-time due to unforeseen circumstances and power outages due to scheduled down-time for Seattle City Light or SMT Building Maintenance.

Funding Requirements and Unmet Funding Needs:

The budget for the TMC is allocated from the combined general maintenance budget. Approximately $50,000 is allocated to the costs of maintenance, which covers the annual cost of replacement of electronic components that make up the TMC, and $675,000 is allocated to the cost of operations.

A more detailed inventory of TMC components and a programmed schedule for replacement of them will determine if additional funding is required. The video wall is the longest-lived component of the TMC, requiring replacement in 2014 and does not present an immediate funding need.

The TMC is a one-of-a-kind asset that will not grow in number similar to other infrastructure assets. However, there are elements of growth that may require additional funding:

- ✓ Increasing functionality as newer technology is made available
- ✓ Creation of a back-up site

Traffic Signal Assemblies:

A traffic signal assembly is the set of assets that comprise a functioning traffic signal at a given intersection or location, from the overhead equipment and poles, to the controller cabinet and electronics within it that operate the traffic signal. The asset hierarchy for signals was revised during the 2008 inventory and condition assessment effort to include the detection system components as component assets of the signal as opposed to being an independent asset.

A traffic signal assembly controls the movement of vehicles, pedestrians and bicyclists, minimizes conflicts, and optimizes the flow of traffic throughout the street network.

Traffic Signal Assembly

Current Inventory, Condition Rating, and Anticipated Annual Growth:

There are 1051 traffic signal assemblies in the city of Seattle as of this update to the Status and Condition report. The signal inventory is maintained in the Hansen system. The inventory of traffic signal assemblies is verified annually during preventive maintenance visits to each location.

As of 2008, an overall condition rating has been assigned to the traffic signal assemblies, based on the condition information of the component assets, such as poles, mast arms, spans and connections. This condition information has been collected in a comprehensive effort in 2008 and is stored in the Hansen system.

As many as ten (10) new traffic signal assemblies are installed each year. Some of these new traffic signal assemblies are installed by developers as a requirement under a development permit. These new signals are then turned over to SDOT for maintenance and operation. SDOT may be responsible for adding as many as three per year.

The estimated replacement value of traffic signal assemblies is $50-100 million in current dollars. Where expressed elsewhere in this document for summary purposes, a replacement value of $78,825,000 has been used.

Useful Life and Life Cycle Costs:

A traffic signal assembly has an open-ended life and persists through time as long as the intersection or mid-block location remains signalized. Deteriorating or failed component assets are replaced, rather than replacing the traffic signal assembly in its entirety. The component assets each have a varying life cycle from 1-25 years.

Acquisition and installation costs range from $50,000-$200,000. Maintenance costs are not tracked separately and are included in the general maintenance budget; hence, life cycle costs are not available.

Maintenance Approach:

The maintenance approach for traffic signal assemblies is to correct problems identified during annual preventive maintenance of the controller cabinet, and to respond to damage or operational problems as reported and according to maintenance priorities. A traffic signal assembly is expected to operate correctly 99.9% of the scheduled up-time.

The condition information that has been collected via visual inspection on components of the signal assembly, such as mast arms and connections, has formed the basis for prioritizing maintenance work to replace aged or damaged components.

BTG has provided the opportunity to conduct preventive maintenance on an annual basis. BTG has also provided funding to install additional traffic signal assemblies or to increase the functionality of existing traffic signal assemblies. With BTG funding, a cabinet/controller replacement program has been implemented.

Current Performance Measures:

SDOT's Traffic Management division has established the following performance measures for traffic signal assemblies, as well as some of the components:

Performance Measure	2009 Actual	2010 Goal
Traffic signal assembly maintenance events	1041	1040
Electric traffic control devices evaluated	296	225
Electric traffic control devices installed, modified or removed	50	50
Replace traffic control cabinets	10	7
Locations improved for pedestrian safety	11	10
Left turn signal improvements evaluated at intersections	20	20
Left turn improvements installed at signalized locations	3	3
New traffic signal request studies completed	64	50
New traffic signal assemblies installed	4	3
Pedestrian countdown signals installed at intersections	40	40

Funding Requirements and Unmet Funding Needs:

Approximately $3.4 million from the 2010 combined general maintenance budget has been allocated for maintenance of traffic signal assemblies.. In addition, approximately $300,000 has been provided in a separate budget for installation of new traffic signal assemblies.

Maintenance costs are not tracked at the asset level, so accurate information on the actual cost of maintenance is unavailable, and it is difficult to determine whether current funding is sufficient to address routine maintenance needs for the existing traffic signal assemblies. As the number of traffic signal assemblies increase each year, additional funding will be required to maintain these devices.

A traffic signal assembly consists of numerous components, all of which have differing useful lives. As of 2007, BTG provided modest funding to replace controller cabinets and SDOT has replaced from 10 to 20 per year since then. For the 1,000+ signalized locations, it will take in excess of fifty (50) years to replace the SDOT inventory of cabinets/controllers, and additional funding will be required to replace cabinets/controllers in accordance with the useful life or to upgrade the cabinets/controllers to introduce enhanced features or functions at signalized locations.

A replacement program will need to be developed for the other components of a traffic signal assembly as well. Absent such a replacement program and accurate tracking of maintenance costs, the number of aging components that can be replaced given current funding levels is indeterminate.

Traffic Signal Communication System:

The traffic signal communication system is the network of cables, switches, cabinets, and controllers that link the traffic signal system and is the vital link between the traffic signal assemblies, the CCTV camera assemblies, and the TMC. It is the backbone through which all traffic signal data, as well as video, are transmitted, allowing for communication between these devices and assisting in the efficient operation of the traffic signal system, dynamic message sign system, and the CCTV camera system.

The traffic signal communication system is comprised of two (2) major components:

- ✓ Terminal cabinets – These serve as junctions in the communication system, housing a variety of electronic communications equipment.
- ✓ Interconnect – The Interconnect is the network of communication cables which run overhead or through underground conduits.

Current Inventory and Anticipated Annual Growth:

There are 25 terminal cabinets in the traffic signal communication system. The inventory of terminal cabinets is maintained in a database in the Traffic Signal Shop. Approximately one (1) new terminal cabinet is installed each year.

The number of linear feet of the Interconnect is unknown. The location of the conduits and hand holes has not been recorded. Approximately two (2) miles of new cable are installed each year.

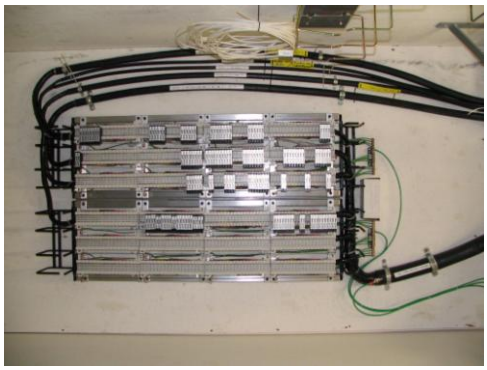
The estimated replacement value has not been determined.

Useful Life and Life Cycle Costs:

A terminal cabinet can be expected to have a useful life of twenty (20) years and costs approximately $10,000 to install. After approximately fifteen (15) years, it generally degrades to fair condition. If it degrades to poor condition, the terminal cabinet will require replacement in one (1) year. Electrical components within the terminal cabinet, such as switches, have useful lives that average four (4) years.

The useful life of the Interconnect is indeterminate. Installation cost of each new mile of cable is approximately $50,000.

Maintenance costs have not been tracked independently for this asset and have been included in a general maintenance budget, hence, life cycle costs are not available.



Components of the Traffic Signal Communication System

Maintenance Approach:

The maintenance approach for the traffic signal communication system is to respond to damage or operational problems as reported and according to maintenance priorities. The traffic signal communication system as a whole is expected to operate correctly 99.9% of the time.

Additional funding is required to establish a preventive maintenance program for these devices.

Current Performance Measures:

Performance measures have not been developed for the traffic signal communication system.

Funding Requirements and Unmet Funding Needs:

Approximately $350,000 from the combined general maintenance budget has been allocated for maintenance of the traffic signal communication system.

Maintenance costs are not tracked at the asset level, so accurate information on the actual cost of maintenance is unavailable. One (1) FTE has been allocated for maintenance of the traffic communication system, and this appears adequate to keep the system functioning.

A replacement program has not been developed for the terminal cabinets. Since each cabinet has a useful life of twenty (20) years, approximately 1.25 of these should be replaced each year and will require additional funding of $12,500 annually.

Very limited information is available about the interconnect. Maintenance is performed as needed, however, the information is not available to determine what level of replacement activity is included in this maintenance. At some point, portions of the interconnect can be expected to be replaced. A replacement program has not been developed for the interconnect, and an annual funding figure for replacement is not available.